THE

ONTARIO WATER RESOURCES

COMMISSION

MUSKOKA LAKES

EUTROPHICATION STUDY

REPORT NO. 1

July 1971

Ontario
Water Resources
Commission

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Mrs. A Burger

Water management in Ontario

January 27, 1972

Dear Sir:

Attached is a report entitled "Muskoka Lakes Eutrophication Study - Report Number 1" which was prepared by personnel of the Biology Branch of this Commission.

As you are aware an ongoing water quality investigation was initiated on Lakes Joseph, Rosseau and Muskoka in May of 1969 and progressed on through the summer of 1971. The overall objective of the study was to assess the status of nutrient enrichment and to determine the rapidity with which changes were occurring, in order to promote remedial measures before the good water quality, which exists throughout most of the system is jeopardized.

This first report, of a series, is designed primarily for the users of the Lakes and presents information on the historical development of the area, explains the nature of problems associated with water quality in Precambrian Lakes, provides a brief outline on the scope of the study and presents the results of a survey of cottagers which was carried out as an initial effort to obtain general information on water use, and to acquire data which were being used in the development of specific aspects of the study.

Additional reports relating to the more technical investigative and experimental aspects of the Muskoka Lakes Studies are now under development and will be distributed as they become available.

The report indicates that the arrest of eutrophication in Precambrian cottage country is in part a question of convenience and alternative methods. As such, recommendations relate to individual initiative and participation.

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Please do not hesitate to contact us should you have any questions pertaining to the report. Additional copies are available upon request.

Yours very truly

John H. Neil

John H. Neil
Director,
Division of Laboratories

MFPM/mb

MUSKOKA LAKES

EUTROPHICATION STUDY

Report No.1

Background Information and

Survey of Cottagers

By

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Biology Branch

July 1971

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F O R E W A R D

Between 1965 and 1967, numerous complaints concerning troublesome levels of algae in Muskoka Lake (Gravenhurst Bay in particular) led to the completion of a preliminary limnological survey in the summer of 1968. Accelerated eutrophication (aquatic enrichment) was demonstrated in Muskoka Bay while good water quality was detected throughout the remainder of the lake.

As a result of this preliminary study, it was decided during the winter of 1968-1969 that a thorough multi-disciplinary water quality evaluation be conducted on Lakes Muskoka, Joseph and Rosseau. The overall objective of the two-year investigation, which commenced in May 1969, was to assess the status of nutrient enrichment and to determine the rapidity with which changes are occurring, in order to promote remedial measures before the good water quality which exists throughout most of the system is jeopardized. It is expected that the findings of the study will be applicable to many soft-water lakes in the Precambrian Shield region of Ontario and will afford a much better understanding of water quality problems in such lakes.

This first report of a series presents information on the historical development of the Muskoka Lakes, explains the nature of problems associated with water quality in Precambrian Lakes, provides a brief outline on the scope of the study and presents the results of a survey of cottagers which was carried out as an initial effort to obtain general information on water use and to acquire data which were being used in the development of specific aspects of the study.

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HISTORICAL DEVELOPMENT

The work "Muskoka" originates from the name of a Chippawa Indian Chief "Musqua Ukee" or "Yellowhead".

It is reported that the first white man in the Muskokas was a member of Samuel de Champlain's expedition. As more people ventured into the area, fur trading became the main enterprise, negotiated with local Indians. By 1820, trading posts were established on Yoho Island in Lake Joseph and at the mouth of the Muskoka River. However, the industry was short-lived as resources were virtually depleted by 1840.

In 1850, the government purchased Muskoka from the local Indians for a single payment and yearly stipend. Eventually, reservations were established, the largest of which still exists along the Muskoka River west of Bala. With the arrival of farmers and loggers in the early 1850's, a road was constructed between Washago and Muskoka via South Falls. In 1866, the first steam-powered vessel, the "Wenonah" went into operation towing log booms across the lake from the upper Muskoka River (east of Lake Muskoka) to the lower Muskoka River (west of Lake Muskoka). The logs were subsequently floated down the lower Muskoka River to mills on Georgian Bay. However, by 1870, timber supplies were exhaused in all areas accessible from Lake Muskoka and the lower Muskoka River. Subsequently, lumbering operations expanded into the Huntsville-Lake of Bays area. In 1871, the potential timber resources were expanded with the construction of the Port Carling locks which provided easy access to Lakes Joseph and Rosseau. Spurred on by the lumber trade, population reached a peak between 1869 and 1873. for example, McCabe's Bay (Gravenhurst) had a steam-driven sawmill, a shingle mill, two hotels and an assortment of smaller buildings. North Falls (Bracebridge) boasted several sawmills and three hotels.

The now-flourishing tourist industry began in the Muskoka Lakes in 1870 when Pratt's Hotel opened in the village of Rosseau. The Port Cockburn Tourist Hotel was built in 1872 at the northern end of Lake Joseph and a convenient stage line linked these two establishments with Parry Sound. By 1875, the Northern Railway extended its line through Muskoka to connect with the CPR near Lake Nipissing.

Near the end of the century, Gravenhurst was a flourishing lumber community supporting fifteen sawmills; ten were located within Muskoka Bay while five more were situated immediately outside "The Narrows". In addition, two saw mills were located at the north end of Muskoka Lake at Port Carling. Today, the hundreds of water-laden logs which cover the bottom of Muskoka Bay are evidence of the extensive booms which served these mills. No reforestation programmes were practised and eventually all virgin stands disappeared from both sides of Lake Muskoka.

During this same period, demand for summer recreational activities and vacation properties increased. Many farmers, discouraged with the rocky terrain and poor soil fertility, built tourist resorts. By 1893, 200 summer residences catered to a total capacity of 1,400 people. In addition, 11 resorts accommodated another 1,400 tourists.

In response to the diversified needs of the Muskoka area the steamboat's role was altered from tugboat to supply boat, operating on behalf of the cottagers. In 1907, the steel-hulled, coal-burning "Sagamo" was launched. Equipped with twin propellors, the "Sagamo" was fast enough to cover Lakes Joseph, Rosseau and Muskoka in a single day. By 1910, twelve passenger and seven supply steamers were in operation;

in addition, approximately 40 hotel steamers and private yachts as well as 11 tugs catered to a hotel and cottage capacity of 3,000 and 1,800, respectively. However, increases in road construction led to the inevitable demise of the steamboats. Between 1951 and 1958 only two steamers (the "Sagamo" and the "Segwun") were in operation. Subsequently, the "Sagamo" became a floating restaurant until it burned in 1969 and the "Segwun" was converted into a steamboat museum at Gravenhurst, thus bringing an end to a once-glorious era of water travel.

In the 1920's and 1930's more cottagers were encouraged into the Muskokas by the rise in popularity of the automobile, the construction of paved roads and the technological conveniences of electrical, gasoline and diesel power. The presence of financial giants such as the Carnegies, Rockefellers and Seagrams made the Muskoka Lakes the leading prestige resort area in North America.

In 1954, the total capacity of tourist owned summer cottages approximated 18,000. Hotel capacities which reached a peak of 5,000 at the end of World War II dropped to 3,900 in 1963, undoubtedly owing to an increase in private ownership of small summer homes. By then, the era of cottage development involving a broader stratum of a generally more affluent population was well underway. More recently, the demand for cottage space together with new trends such as the snowmobile, the winterization of cottages and the establishment of permanent and/or retirement homes at the lake are providing just cause for concern relative to the future of water quality in the Muskoka Lakes.

WATER QUALITY IN PRECAMBRIAN COTTAGE COUNTRY

Bacteriological Water Quality

For many years, cottagers have generally equated water quality with the presence or absence of coliform or fecal coliform bacteria in the water. Certainly, localized bacteriological problems in recreational lakes associated with inadequate or malfunctioning cottage waste treatment systems are still all too frequent.

In June 1970, the Ontario Water Resources Commission implemented changes in the criteria for bacteriological quality of water. Under these criteria, water used for total body contact recreational activities is impaired when the coliform, fecal coliform, and/or enterococcus geometric mean density exceed 1000, 100 and/or 20 per 100 ml. respectively, in a series of at least ten samples per month, including samples collected during weekend periods (OWRC 1970).

Separate criteria are in force for private water supplies for individual dwellings and cottages. The raw water must be of such quality that it can be used with a minimum of treatment, limited to disinfection, filtration and/or softening. Microbiological criteria for private water supplies is provided in Table 1.

Although bacteriological contamination is undoubtedly of most direct significance to cottagers, this type of pollution can be readily identified and through the implementation of effective controls, a rapid return to satisfactory water quality can be achieved.

Eutrophication

It is only within recent years that the more lasting effects of a type of pollution best described as nutrient enrichment have become clearly recognized. This process, scientifically known as EUTROPHICATION, is associated with

Table 1. Microbiological criteria for private water supplies.

Micro-organism	Permissible Criteria		Desirable Criteria
	Chlorination only	Chlorination and Filtration	No Treatment
Coliforms (35°C)	100/100 ml	400/100 ml	0/100 ml
Fecal coliforms (44.5°C)	10/100 ml	40/100 ml	0/100 ml
Enterococci (35°C)	1/100 ml	4/100 ml	0/100 ml
Total bacteria (20°C)	1000/100 ml	4000/100 ml	10/100 ml
Clostridia (in water) (35°C)	0/100 ml	4/100 ml	0/100 ml

Raw water samples should be collected at least monthly. The Geometric Mean of sample results should not exceed the values given in the table above.

sedimentation and increases in the dissolved mineral content of a lake - specifically substances such as phosphates, nitrates, carbonates and numerous trace elements - increases which occur as a result of rainfall, land run-off and percolation of soil-water to the lake. Higher concentrations of these dissolved materials cause the water to become progressively more fertile and productive, stimulating the development of free-floating microscopic plants called phytoplanton, generally referred to as algae.

Algae are normal inhabitants of virtually all surface waters and fulfillan essential role in maintaining a balanced condition in the aquatic environment. They not only provide the entire nutritional base for a complex aquatic food web which includes the production of game and commercial fish species, but produce and release oxygen to the water which is vital to the metabolism of fish and all other forms of aquatic life.

The natural development of algae is regulated not only by nutritional factors, as previously mentioned, but by environmental factors such as temperature, the intensity and duration of illumination (sunlight) and by physical factors such as size, depth and shape of the lake bottom. Thus, the corresponding rates of eutrophication in different lakes are determined by varying combinations of extrinsic and intrinsic features.

All lakes, even the largest and deepest, are transitory bodies of water and are continually undergoing a gradual process of change from youth to maturity to old age, or, in limnological terms, from oligotrophy to mesotrophy to eutrophy. Progressing even further, death of a lake can be equated to the onset of a "swamp" or "marsh" condition. In small, shallow

lakes this entire process may have occurred in some cases within a single century following the glacial retreat; in other instances, the process is well advanced, and still going on, and in many larger, deeper lakes remote from human influences, significant changes can only be measured on a geologic time scale (i.e. thousands of millions of years).

Lakes surrounded by granitic bedrock and infertile soils of the Precambrian Shield are characterized by low rates of algal production and consequently age less rapidly than lakes surrounded by the deeper, richer soils of Southern Ontario. Correspondingly, "nutrient-poor" lakes on the "Shield" having moderate to extreme depths, generally support a relatively low production of cold-water fish species such as lake trout, whitefish and herring. They are characteristically clear and well-suited to swimming and other water-orientated recreational activities. Also, the deeper waters of many of the larger lakes are well supplied with oxygen throughout the year. This latter condition relates to the low algal production and concomitant lack of any significant oxygen depletion associated with the decomposition of algae at the lake bottom.

As mentioned earlier, all lakes are subject to natural inputs of algal-stimulating nutrients from the atmosphere, ground-water, run-off from the surrounding land and forest and nutrient exchange from lake sediments. However, under the influence of artificial (man-made) enrichment owing to inputs of wastes, eutrophication is dramatically accelerated. Affected lakes are characterized by increased phytoplankton levels, the development of high numbers of blue-green algae in late summer and reduced pH and dissolved oxygen concentrations in the deeper waters associated with the decomposition of settled algae and higher carbon dioxide, nutrient and iron

levels, again particularly evident in the deeper water where reducing conditions prevail.

Associated undesirable effects of induced eutrophication in one or more lakes studies by the OWRC have been a reduction in water clarity and related impairment of the recreational and aesthetic qualities of the water, objectionable accumulations of blue-green algae along shorelines and associated malodorous conditions on decomposition, a decrease in the quality of water for drinking and domestic purposes including clogging of water intake filters, a reduction of the area suitable for game fish owing to oxygen reduction in the deeper waters and a further reduction in fish production through elimination of desirable fish-food organisms.

OWRC Investigations Related to Eutrophication Assessment

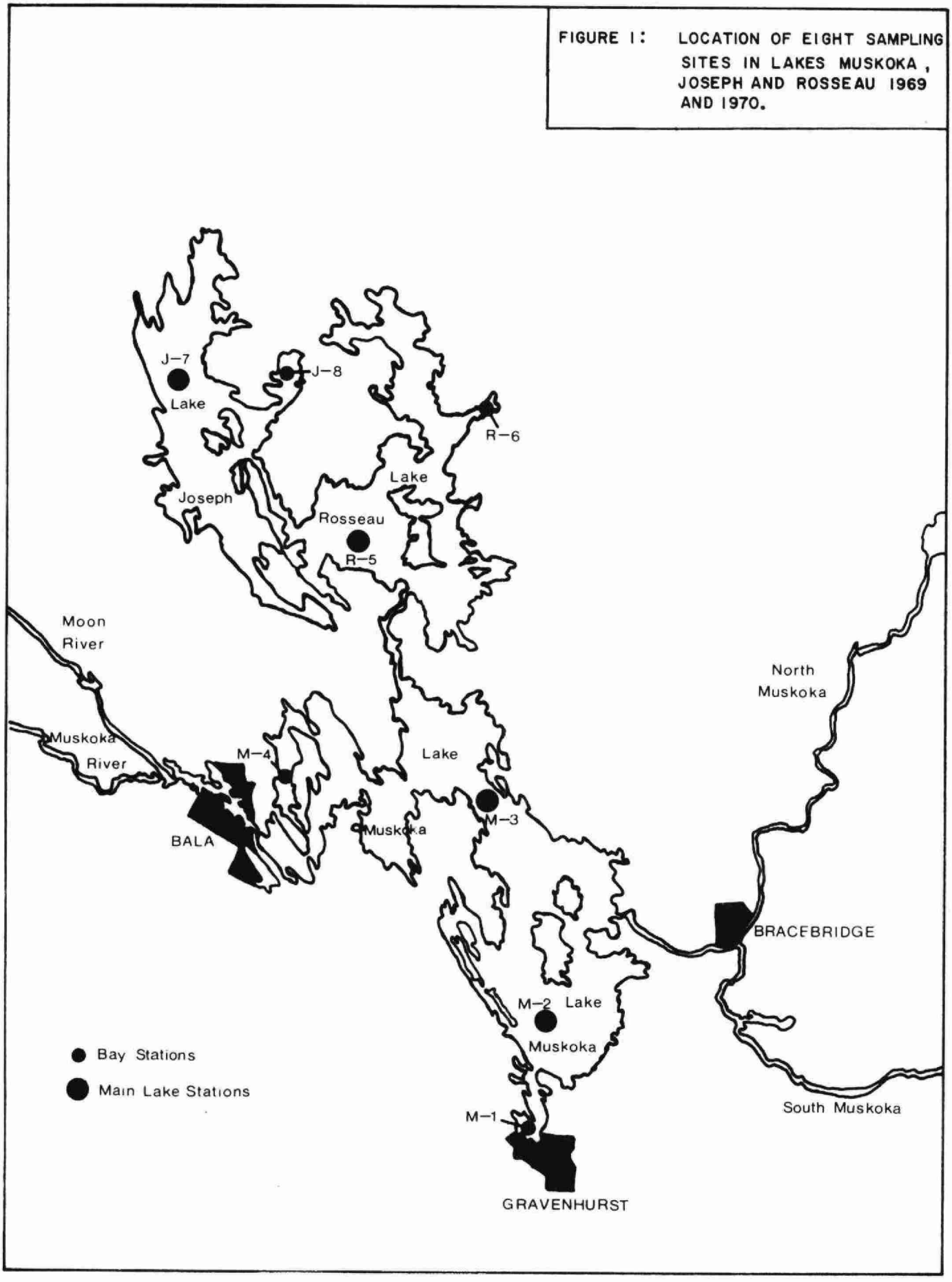
In May of 1969, the OWRC initiated a two-year period of study to be followed by continuing evaluations on the Muskoka Lakes. The overall objective of the programme was to determine the current trophic status of various portions of the Muskoka Lake system, to assess the rapidity with which changes are occurring and to promote remedial measures before the good water quality which persists throughout most of the system is jeopardized.

The Muskoka Lakes were chosen because they provided an area of investigation where it was possible to find within the one system; examples of "nutrient-poor","nutrient-rich" and various intergrading types of lakes and bays - some affected by cottage wastes only and others by both cottage and municipal development. Additionally, contacts with cottagers of the Muskoka area suggested that they were likely to be co-operative in implementing pollution abatement practices where the need is demonstrated.

During 1969, phytoplanktonic, zooplanktonic and bottom faunal populations were evaluated at eight locations throughout the system (Figure 1) in light of physical measurements, nutrient determinations and other water chemistry analyses, profiles of dissolved gases and bottom sediment types. Primary productivity assessments were made by means of labelled carbon-14 uptake studies. Algal growth potential measurements were conducted under controlled conditions in the laboratory and in plastic bags submersed in the lakes in order to determine what nutrients were limiting algal growth.

In 1970, a shift of emphasis was provided to define the relative importance of all sources of nutrients as far as each lake and bay is concerned. These data will be combined with the results of nutrient analyses completed for stations throughout the lakes to develop a total nutrient budget for the Muskoka system. A good portion of the 1970 summer programme was related to an evaluation of nutrient translocations to the water from specific septic tanks system by acquiring historical information on occupancy, detergent use and washing practices at individual cottage sites since the cottages were first built, followed by, obtaining soil and soil-water samples to describe the zone of effect from the tile system and to determine what proportion of the total nutrient loading has been retained in the soil. Calculations of loadings from sewage treatment plants and measurements of import and export of nutrients between bottom sediments and overlying waters were determined. Additionally, studies were completed on plastic bags submersed in the lake; the bags were treated with effluents from a conventional secondary sewage treatment plant and with similar effluents which had been treated for phosphorus removal. Finally, an investigation was completed which assessed the effects of carbon, lead and tastes and odours resulting from outboard motor exhaust on water quality.

FIGURE 1: LOCATION OF EIGHT SAMPLING SITES IN LAKES MUSKOKA, JOSEPH AND ROSSEAU 1969 AND 1970.



Summarization of the data generated by this study should afford a much better understanding of the recreational lakes problem since the Muskoka Lakes are generally representative of geological and topographical conditions throughout a large portion of our vacation and wilderness area. A number of sectional reports are to be issued dealing with various phases of the programme. A flow chart summarizing the internal breakdown of the programme is provided in Figure 2.

SURVEY OF COTTAGERS

Nature of the Survey

An initially important aspect of the Muskoka Lakes Eutrophication Study was a questionnaire survey which was carried out primarily to acquire data which could be used to complete the development of specific aspects of the investigation. For example, a quantitative evaluation of the relative importance of artificial and natural sources of nutrients is the substance of the second report in this series. Completion of this report necessitates information such as degree of cottage use (i.e. number of man-days per year spent at each cottage) and amount of detergents used at each cottage. In addition, since phosphorus is generally considered to be the nutrient most amenable to control, and since on the basis of early field and laboratory results, it was found that phosphorus was extremely significant in promoting the development of algal "water-blooms", the questionnaire investigated thoroughly the use of detergents and washing practices in general, as well as water supply and waste treatment systems. Finally, complementary data on shoreline densities and availability of low-phosphate washing compounds throughout the Muskoka area were collected.

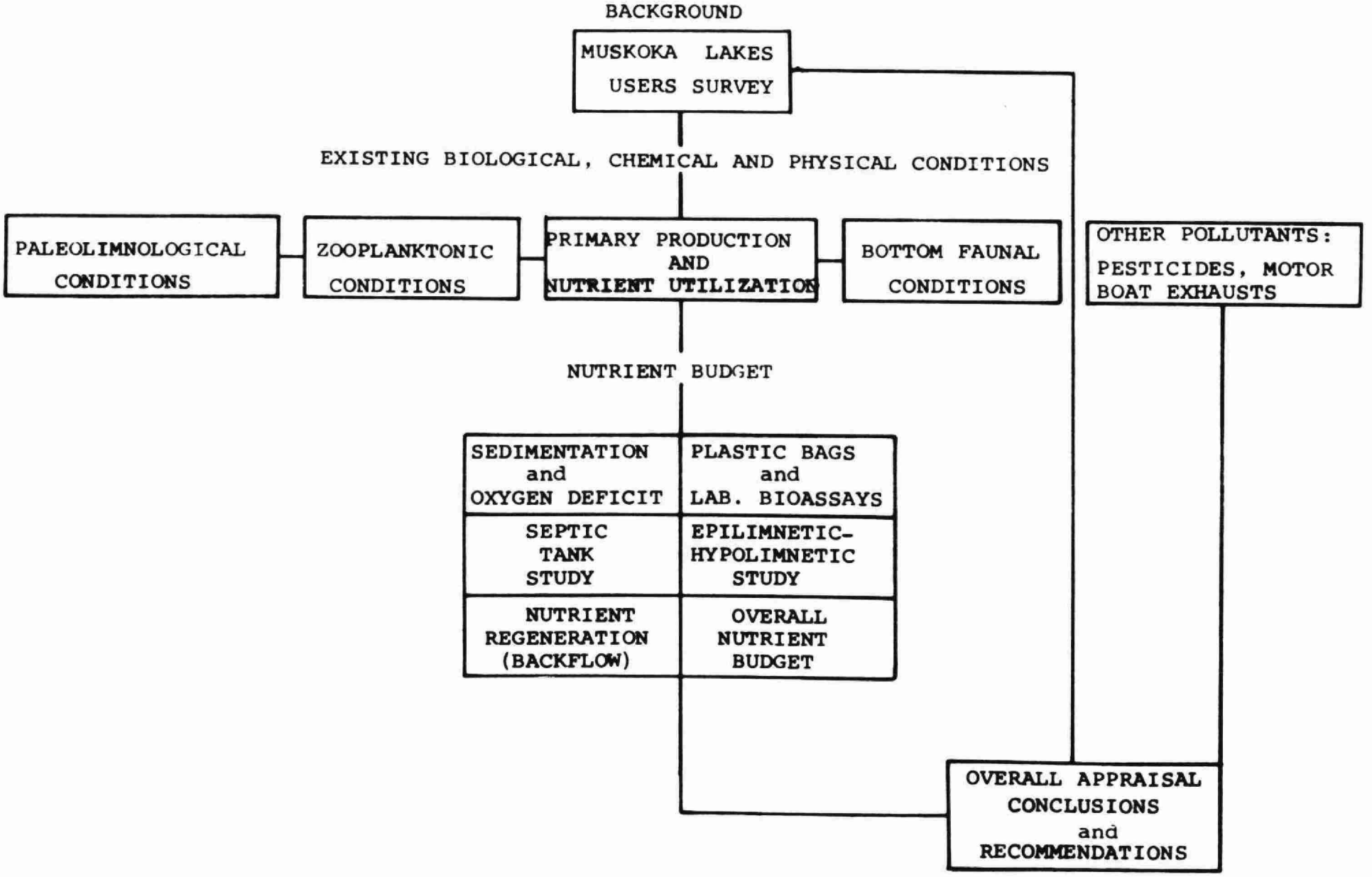


FIGURE 2 FLOW CHART SUMMARIZING INTERNAL BREAKDOWN OF MUSKOKA LAKES EUTROPHICATION STUDY 1969 AND 1970.

Methods

During the winter of 1970 three hundred questionnaires were mailed to owners of shoreline property along Lakes Muskoka, Joseph and Rosseau. Names and addresses were randomly selected from municipal office listings. Pre-addressed, stamped envelopes were included with each questionnaire. The format of the questionnaire is provided in Appendix A.

During October 1970, Biology Branch personnel carried out by boat a "cottage-count" throughout the entire Muskoka Lakes system. A cottage was arbitrarily defined as any "unit" which required a sewage disposal system. For example, kitchens or bedrooms situated above boat-houses or sleeping cabins separated from the main cottage were included in the estimate. It should be realized; therefore, that the number of "units" on the shoreline of any one bay or lake would be higher than the actual number of cottage owners.

In September, October and November, staff canvassed a total of eight stores in Gravenhurst (3), Bala (1), Bracebridge (2) and Port Carling (2) to assess the availability of low-phosphate cleansing compounds and to determine whether any buying trends had materialized relative to cottagers using soaps or detergents.

Results and Discussion

Cottage densities and development

An estimate of the number of "cottages" or "units" is provided in Table 2. Again, it should be stressed that the figures presented do not represent the actual number of cottage or property owners but "units" which require a sewage disposal system. Additionally, the table presents data on the degree of cottage occupancy for each of the lakes. These data are expressed as man-days (one person for one day).

Table 2. Number of "cottages" or"units" in Lakes Muskoka, Joseph and Rosseau 1970, and degree of cottage occupancy based on results or questionnaire respondents, 1969.

Location	Number of "cottages" or "units"		Number of man-days of occupancy 1969		
	Mainland	Islands	Maximum	Minimum	Mean
Lake Muskoka	3,328	984	1,000	20	273
Gravenhurst Bay	285	14			
Dudley Bay	202	6			
Lake Joseph	881	147	2,000	10	350
Little Lake Joseph	81	0			
Lake Rosseau	1,250	257	960	2	267
Skeleton Bay	36	9			

It is impossible to assess accurately the total number of man-days for 1969 for each lake by combining data acquired from our "cottage count" and from occupancy figures from the questionnaire, as many property sites were characterized by at least two or more "cottages" or "units". Nonetheless, information obtained from questionnaire respondents revealed that the number of man-days of occupancy in 1969 in Lakes Muskoka, Joseph and Rosseau was 22,100, 15,466 and 13,922, respectively. Thus, the total number of cottage man-days in 1969 approximated 51,500. On the basis of information received from the various district municipal offices, it was conservatively estimated that the total number of questionnaires returned was 4.5% of the total number of property owners on the lakes. Extrapolation of the data indicates that the total number of man-days of occupancy in Lakes Muskoka, Joseph and Rosseau in 1969 approximated 1,144,400.

Cottagers' questionnaire

Information of a general nature which was acquired from the questionnaire is presented in Table 3. The fact that 68% of the questionnaires were completed and returned reflects the growing interest, awareness and concern on the part of cottage owners relative to the problems created by nutrient enrichment in Precambrian Lakes. It was gratifying that 85% of those responding claimed awareness that excess phosphate may cause nuisance algal growths. Of those cottagers affiliated with the Muskoka Lakes Association, 14% were not aware that excess phosphates could promote the development of algal and vascular aquatic plant growths. A similar percentage (i.e. 13%) of the non-affiliated property owners, were not aware that phosphorus inputs to a watercourse could stimulate troublesome algal conditions.

Considering the three lakes, 46% of the respondents indicated that water quality had deteriorated in the Muskokas. However, as indicated, 53.3% of the replies from cottagers

Table 3. Summary of information collected on number of respondents, associated affiliations and pollution awareness gathered during OWRC cottagers survey.

Lake	Muskoka	Joseph	Rosseau
Total number of questionnaires returned	95	45	58
% of questionnaires returned	66.9%	69.3%	68.9%
Percentage of respondents affiliated with the Muskoka Lakes Association, another association, both Muskoka and another or none.			
M.L.A.	44.5%	58.6%	69.2%
M.L.A. +	18.2%	24.1%	10.3%
None	28.2%	17.3%	17.6%
Another	9.1%	-	2.9%
Percentage of cottagers who are aware that excess phosphate may cause nuisance growth of algae.			
Yes	85.6%	91.1%	78.6%
No	12.2%	8.9%	21.4%
?	2.2%	-	-
Percentage of cottagers detecting any deterioration in water quality.			
Yes	53.3%	44.4%	41.0%
No	46.7%	55.6%	53.6%
?	-	-	5.4%

owning property on Lake Muskoka indicated an impairment in water quality, owing to a reduction in water clarity, to growths of algae on rocks, docks, boats or boathouses, and to the development of weed beds. The fact that a cottage owner was or was not affiliated with a local association had no bearing on his perceiving changes in water quality. Figure 3 presents information which indicates that signs of water quality impairment were more apparent for those cottagers who have vacationed for periods in excess of 20 years. Certainly, these cottagers are in a much better position to judge whether water quality has or has not deteriorated.

The bar graphs in figures 4a and 4b provide information on water supply and sewage treatment systems for cottages on Lakes Muskoka, Joseph and Rosseau. Considering the three lakes, 85% obtain their drinking water directly from the lake, 4% have drilled or dug wells, 5% are on municipal supply systems and 6% employ a variety of other methods. It should be emphasized that the value obtained for cottages or permanent residents linked to municipal supply systems is incorrect if this figure is applied to the entire Muskoka Lakes system as Lakes Joseph and Rosseau lack municipalities serviced by individual distribution systems. Most cottagers either boil water or provide no treatment for water used for domestic purposes. However, those accounted for in the no-treatment category probably include cottagers who transport their water from the city or from local municipal water supplies including treated dug wells. Again considering the three lakes, 90% of those answering the questionnaire use the septic tank-tile field system for treating cottage wastes, 7% indicated the use of pit privies, 1% employ holding tanks and 1% use

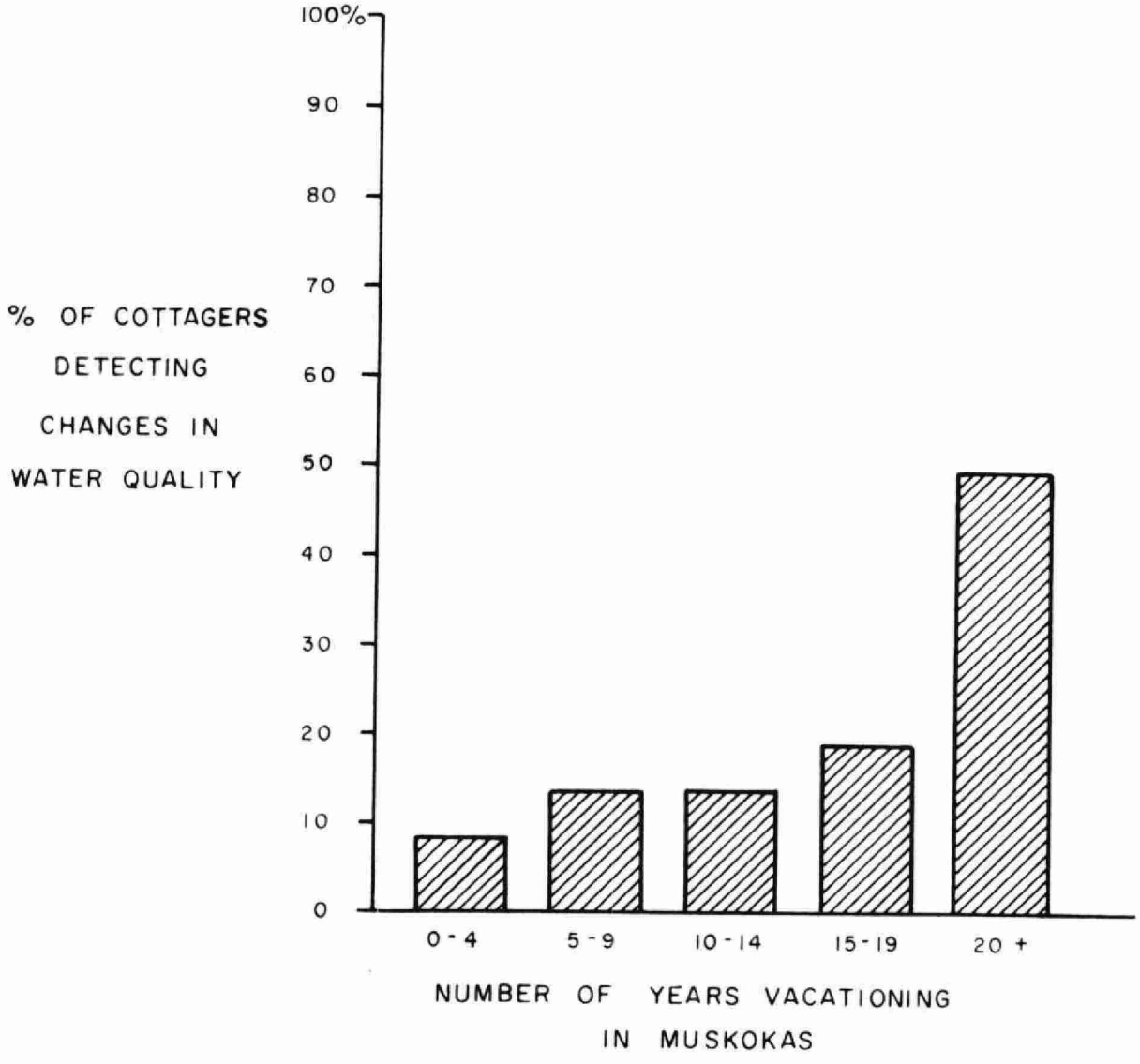


FIGURE 3 GRAPH DEPICTING RELATIONSHIP BETWEEN THE NUMBER OF YEARS SPENT IN THE MUSKOKAS AND THE PERCENTAGE OF COTTAGERS THAT HAVE DETECTED CHANGES IN WATER QUALITY.

WATER SUPPLY AND TYPES OF TREATMENT

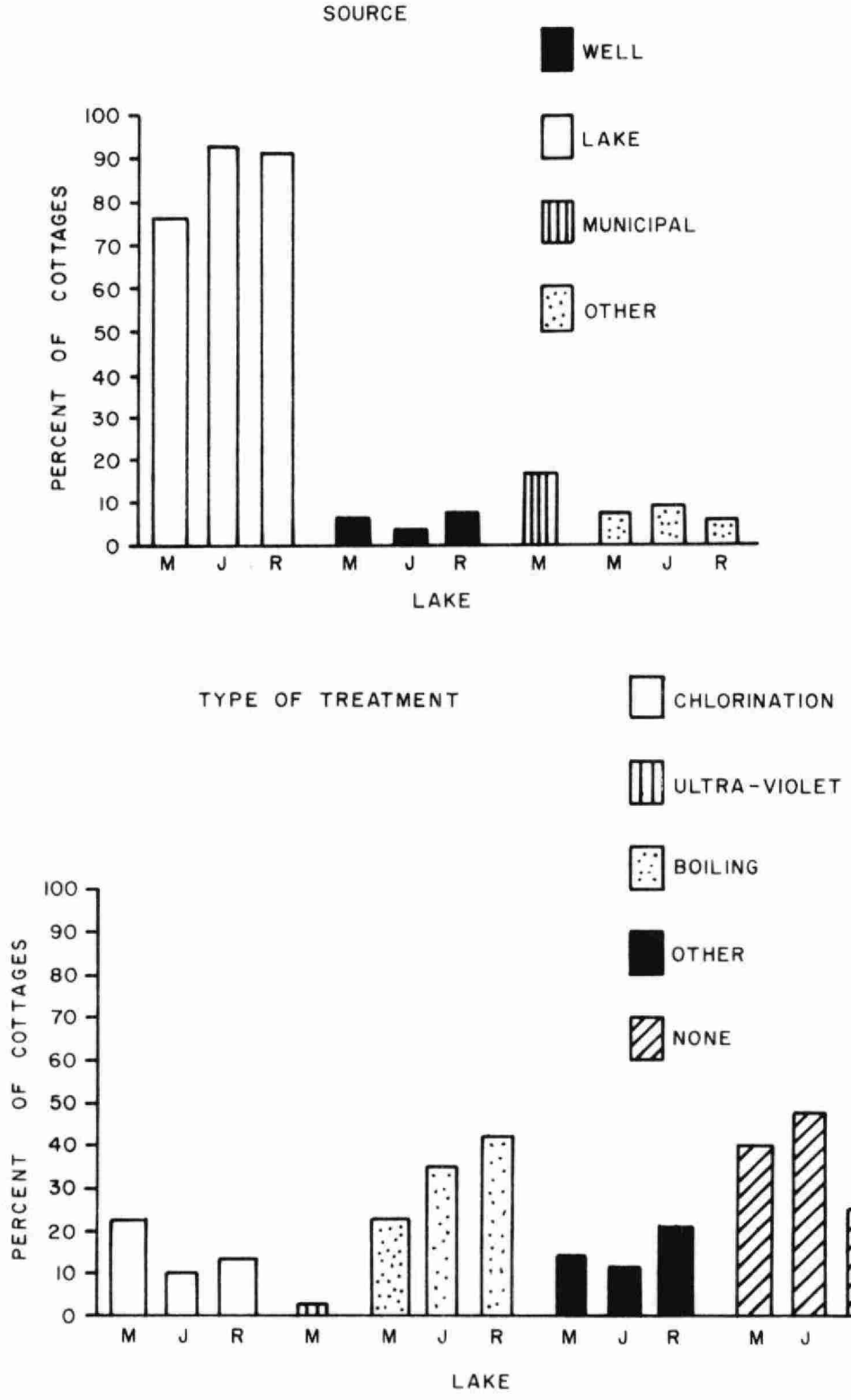
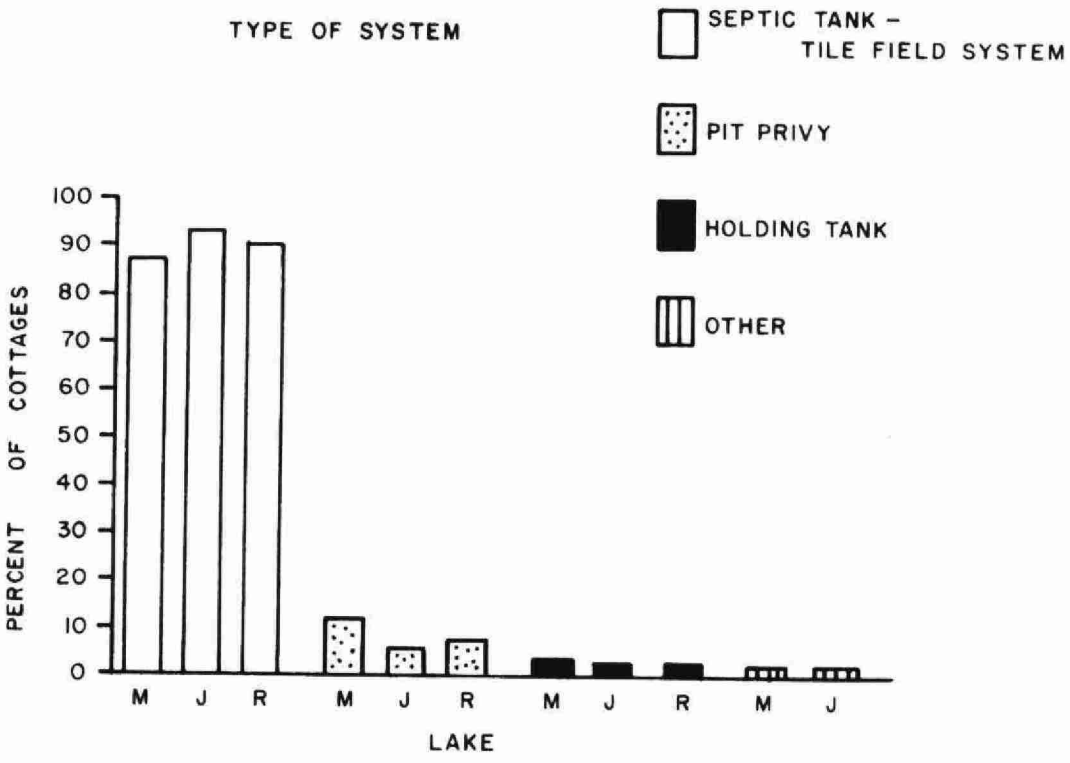


FIGURE 4A INFORMATION ON SOURCES OF WATER SUPPLY AND TYPE OF TREATMENT FOR COTTAGES ON LAKES MUSKOKA (M), JOSEPH (J) AND ROSSEAU (R) 1969

DOMESTIC SEWAGE DISPOSAL SYSTEMS



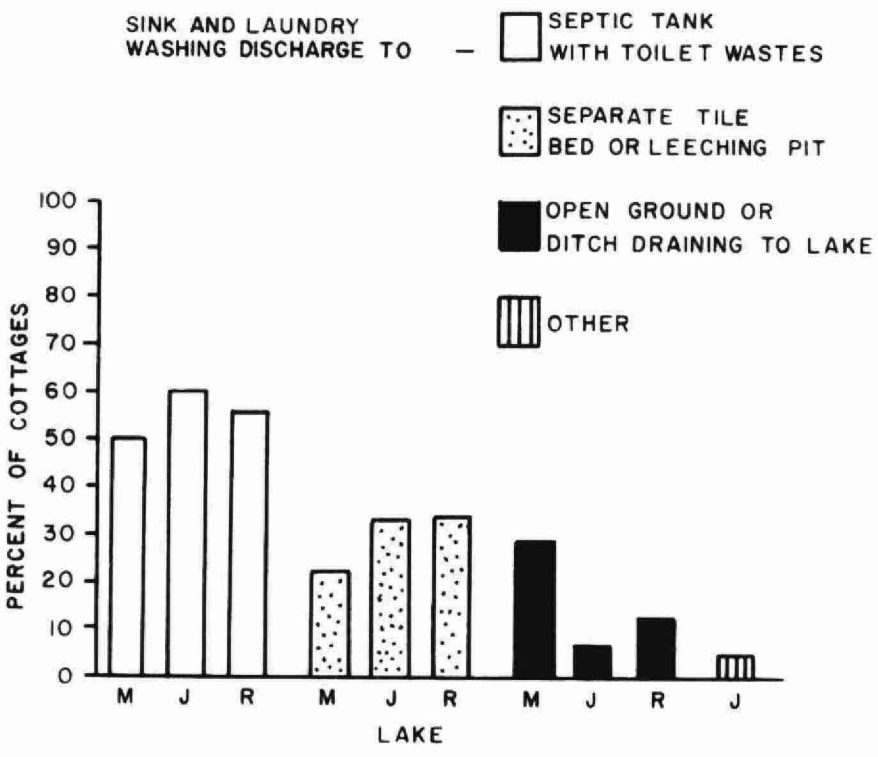


FIGURE 4B

INFORMATION ON TYPES OF DOMESTIC SEWAGE DISPOSAL SYSTEMS IN LAKES MUSKOKA (M), JOSEPH (J) AND ROSSEAU (R) 1969.

a variety of other systems. It is of further interest that slightly more than half of those replying discharge their sink and laundry wastes directly to their septic tanks, 29% have a separate facility for these wastes, 12% discharge wash waters on the open ground, or in a ditch to the lake and the remaining 3% have combinations of these practices.

In answer to a series of questions on laundering (Table 4), 53% said they do their laundering at the cottage, 18% at laundromats in the cottage area and 13% use a combination of cottage and laundromat facilities. Therefore, over 80% of all washing activity by summer residents may contribute to a pollutional effect on local recreational lakes. Of the group of cottagers using laundromats, 83% indicated that phosphate-free soaps were not available from coin-operated dispensers; less than 2% found such washing compounds available, while 15% offered no opinion. One of the most valuable pieces of information was that 55% of those washing at their cottages or in local laundromats have used high-phosphate detergents in the past. However, as a result of recent publicity and probably under some influence of the questionnaire, some 83% of this group intended to use only soap or phosphate-free detergents in the future.

During the summer of 1969, phosphate-free soaps were readily available in local stores or supermarkets to only 29% of the respondents. A canvassing of local stores revealed that total sales for low-phosphate washing compounds were virtually negligible during the early summer of 1970. For example, various store managers estimated that heavy duty detergents were outselling low-phosphate brands by as much as 20:1. In contrast, this ratio was reduced to approximately 6:1 for later months (August, September and October) of the year. In some cases, store

Table 4. Information on laundering practices in Muskoka, Joseph and Rosseau Lakes, 1969.

Lake	Muskoka	Joseph	Rosseau
When vacationing most of the laundry washing is done -			
at the cottage	63.3%	44.4%	52.6%
at the laundromat in local town	22.2%	20.0%	10.5%
both	13.3%	15.6%	10.5%
neither (permanent residence)	1.2%	20.0%	24.6%
other	0.0%	0.0%	1.8%
Availability of phosphate-free soaps at local laundromats			
Yes	89.1%	78.6%	82.3%
No	0.0%	1.6%	2.0%
No reply	10.9%	19.8%	15.7%
Percentage of cottages using high-phosphate detergents in and prior to 1969.			
High phosphate detergents	65.6%	45.5%	55.3%
Soap products	15.6%	33.1%	26.6%
No response	18.9%	22.4%	19.1%

managers indicated that the demand for the more popular soap brands was greater than the supply during this late summer period. Of particular significance was that some store managers erected special promotional stands differentiating low-phosphate soaps from high-phosphate detergents. Certainly such trends and attitudes exemplify that the effects and significance of detergents on water quality are being recognized by cottagers in the Muskokas and that in many instances specific steps are being taken to decrease potential nutrient loadings to the system.

One interesting fact provided from the questionnaire was that 30% of the respondents indicated that they have automatic dishwashers at their cottages, which require the use of cleaning products containing extremely high phosphate concentrations. Discharges from most automatic dishwashers enter directly into septic tank-tile field systems in combination with toilet wastes or into separate tile fields. However, 3.0% of the cottagers having automatic dishwashers discharge sink and wash-water wastes directly onto the open ground.

Some 20% of those questioned indicated the use of lawn and/or garden fertilizers on cottage property.

Recommendation

1. The use of washing compounds containing phosphates should be avoided. Most liquid dishwashing products do not contain phosphates and so do not contribute to feeding algae. If clothes washing is carried out at summer cottages it is not necessary to use granular detergents containing phosphates. since ordinary soap products or phosphate-free detergents will perform adequately in water from soft-water lakes. Although the phosphate content of all household detergents has been reduced to approximately 20% as P_2O_5

(effective August, 1970), the exclusive use of phosphate-free washing compounds would provide a significant reduction in the potential enrichment by phosphates.

2. Cottagers owning automatic dishwashers which require high-phosphate cleansing compounds and which might affect the lake either directly or indirectly (through seepage from septic tank systems) must consider if convenience is worth the price of nutrient enrichment and related upsets in nature's delicate balance. Cottagers should refrain from installing automatic dishwashers if there is any risk of seepage to the lake.

3. Approximately 20% of cottage owners in the Muskoka Lakes (results of OWRC questionnaire) apply lawn and garden fertilizers each year to promote more vigorous growth. Use of fertilizers should be restricted as much as possible and should be discontinued if translocation to the lake is deemed likely.

In summary, the arrest of eutrophication in Pre-cambrian cottage country is in part, a question of convenience and alternative methods. Unless cottagers take time to understand the causes and consequences of artificial nutrient enrichment and the benefits to be derived from assuming their individual responsibilities, water quality is certain to be undermined for future generations.

REFERENCES

ONTARIO WATER RESOURCES COMMISSION, 1970. Guidelines and Criteria for Water Quality Management in Ontario. 26 p.

SCOTT, H.E. 1969. Tales of the Muskoka Steamboats. A History of Muskoka. Herald-Gazette Press. Bracebridge, Muskoka, Ontario. 47 p.

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APPENDIX "A"

WATER-USE SURVEY

MUSKOKA LAKES

The Water Resources Commission advises us that algae and the growth of algae is stimulated by the phosphates being poured into our lakes from the detergents used in dish washing and clothes washing. The following are the trade names of the soaps and detergents that are phosphate-free, and on this basis recommended by the Muskoka Lakes Association to its members for their use: For dish washing - Dove Liquid Detergent, Lux Liquid Detergent, Joy Liquid Detergent, Ivory Liquid Detergent. For clothes washing - Ivory Snow.

From 'Yearbook 1969' - Muskoka Lakes Association

This mail survey is being carried out to assist OWRC and other scientists engaged since 1968 in field and laboratory studies which will provide an evaluation of water quality in the Muskoka Lakes. The public has its part to play in the protection of water quality. Your assistance, by answering the following questions, will be of service to your resort community. All replies are, of course, anonymous. Please return form in the addressed envelope no later than March 15. If you are out of town until past this date, please complete the form and forward it at your earliest convenience.

GENERAL INFORMATION

1. Your lake. _____

2. Your permanent place of residence. (do not give address). _____

3. Are you a member of the Muskoka Lakes Association?

Yes _____

No _____

4. Are you a member of another Cottagers' Association?

Yes _____

No _____

5. How many man-days (one person for one day) were spent by you and your guests at your cottage in 1969? Total of man-days approximately. _____

6. Were you aware that excess phosphates may cause nuisance growths of algae (minute floating plants and attached thread-like plants) in Ontario lakes?

Yes _____

No _____

7. Have you detected any deterioration in water quality (clarity, taste, algal growths on docks, etc.) at your cottage?

Yes _____

No _____

8. Years of vacationing at present cottage: _____

DRINKING WATER SUPPLY

1. What is your source of drinking water and what treatment do you provide?

Source		Treatment	
Direct from lake	_____	Chlorination	_____
Well	_____	Ultra Violet (Aqua-care)	_____
Town water supply	_____	Boiling	_____
Other	_____	Other	_____
		None	_____

TOILET WASTES

1. What type of treatment facility do you have for toilet wastes?

   Septic tank and tile bed _____

   Pit privy _____

   Combustion unit (electric or propane) Holding Tank (no discharge to soil or lake). _____

   Other _____

WASHING PRACTICES

1. Where do you do most of your laundry washing when vacationing?

   At your cottage _____

   At a laundromat in local town _____

   Both _____

   Neither (at place of permanent residence) _____

2. What laundry-washing product did you use during your 1969 vacation?

   High-phosphate detergent _____

   Phosphate-free soap _____

   (If unknown, give name of laundry product) _____

3. What washing product do you intend to use during your 1970 vacation?

   High phosphate detergent _____

   Phosphate-free soap _____
   (If unknown, give name of laundry product) _____

4. What laundry-washing product do you now use at your permanent place of residence?

   High-phosphate detergent _____

   Phosphate-free soap _____

   (If unknown give name of laundry product) _____

5. How much laundry-washing product did you use at your cottage in 1969 (number of boxes times the number of pounds per box)?

   Pounds approximately _____

6. Did you find that phosphate-free soaps were readily available where you shopped during your 1969 vacation?

   Yes _____
   No _____
   Not known _____

7. If you used a laundromat, was there a phosphate-free soap available from coin-operated dispensers?

   Yes _____
   No _____
   Not known _____

8. Where does drainage from your sink and washing machine go?

   Directly to septic tank-tile bed with toilet wastes _____
   To open ground or ditch draining to lake _____

9. Do you have an automatic dishwasher at your cottage?

   Yes _____
   No _____

   If "Yes", what dishwashing compounds did you use in 1969?

   High phosphate compounds _____
   Phosphate-free soaps _____
   (If unknown, give name of compound) _____

LAWN AND GARDEN FERTILIZERS

1. Did you use lawn and garden fertilizers on your cottage property in 1969?

   Yes _____
   No _____

If "Yes", what product and how many pounds?

_____pounds of_____, plus
_____pounds of_____.

Comments:_____
_____
_____
_____
_____
_____
_____
_____